

corrected for elevation: Mt. Washington, 76, 7; Pike's Peak, 63, 7; Cheyenne, 48, 4; Denver, 44, 4; Salt Lake City, 66, 2; Boise City, 67, 5 and Winnemucca, 68, 9.

## WINDS.

*In General*—The prevailing winds, at the Signal Service stations, are shown by arrows on chart No. II. By reference to this chart it will be noticed that the prevailing direction east of the Appalachian Mountains is northwest, except along the immediate South Atlantic coast where more northerly or northeasterly winds prevail; while west of the mountains from eastern Tennessee to the Lower Lakes the prevailing directions are from west to south; in the Upper Lake region and Mississippi valley and thence west to the Rocky Mountains the prevailing direction is northerly, except in Dakota and Montana, where south-east to southwest winds prevail; in the Pacific coast States, southerly to easterly winds predominate, except at Los Angeles and San Diego, which record north and northwest winds.

*Total Movements of the Air*.—The following are the largest monthly movements, as recorded at the Signal Service stations, viz: Pike's Peak, 15,890 miles; Cape Lookout, 11,221 miles; Cape May, 10,612 miles; Thatcher's Island, 10,543; Sandy Hook, 10,279; Indianola, 10,057; Barnegat, 9,146; Cape Henry, 9,093; Cape Hatteras, 8,779; Stockton, 8,602; Dodge City, 8,283; Sandusky, 8,182; Red Bluff, 8,120; Eastport, 7,891 miles.

*The smallest are*: Deadwood, 1830 miles; Lynchburg, 2133 miles; Visalia, 2134 miles; Springfield, 2588 miles; Knoxville, 2605; Augusta, 2717 miles; Nashville, 3246 miles; Salt Lake City, 3568 miles; Cincinnati, 3769 miles; Pittsburgh, 3777 miles; Dubuque, 3865 miles; Boise City, 3877 miles. At Mount Washington a continuous record is not kept, but velocities over 100 miles per hour were recorded on five days.

*Local Storms, Tornadoes &c.*, have occurred as follows: It is to be understood that the high winds, generally accompanying extensive areas of low pressure have already been noticed. 8th, Augusta, Georgia, about 1 a. m. a tornado struck the city in the southwest portion and travelled towards the northeast; its track was about three hundred yards wide and the destruction of property along its course quite large; it was preceded on the evening of the 7th, at 7 p. m., by a thunder-storm, with hail. In referring to this thunder-storm, the observer at Augusta says: "Subsequent investigations of the tornado that followed this storm have lead me to believe that this thunder-storm was an accompaniment of a tornado that devastated portions of Richmond and Burke counties, to the south of this station; about 7:30 p. m. the clouds seemed to be driven towards the east with great velocity, and whirling and rolling furiously; the edge of the clouds nearest the sky was ragged, as if torn by a whirlwind; I could hear during the intervals of thunder a continual roaring sound, like a strong wind in a forest." On the same day (the 8th.) at 7 A.M. a second tornado passed over Fayetteville, N. C., with a waterspout resembling a funnel shaped column of smoke. It moved from SW. to NE., at about 25 miles per hour, and rose and fell, coming to the earth every 800 or 1,000 yards, and while down took trees, fences and houses in its path. It was accompanied with a sound like distant thunder and about  $\frac{1}{4}$  inch rain-fall lasting 15 minutes. A third tornado is also reported on the same day by the schooner "Pride of the East" between Capes Hatteras and Lookout, lasting one hour, with hail and rain. On the 9th, in the vicinity of Jacksonville, Fla., at 3 a. m., "a tremendous wind followed by hail and rain" is reported. 21st, Laconia, Ind., 4 p. m., tornado from SW. width of track 50 or 60 yards, duration from one to two minutes, was accompanied by heavy rain and thunder, and did considerable damage to houses, trees and fences.

## VERIFICATIONS.

*Indications*.—The detailed comparison of the tri-daily weather indications with the telegraphic reports for the succeeding twenty-four hours, shows a general per centage of omissions of 0.2 per cent., and of verifications of 86.1 per cent. The percentages of verifications for the four elements have been; Weather 89.6 per cent.; Wind, 83.6 per cent.; Barometer, 85.6 per cent.; The percentages of verifications by geographical districts have been; New England, 86.8; Middle Atlantic States, 88.7; South Atlantic States, 85.8; East Gulf States, 84.8; West Gulf States, 87.5; Lower Lake Region, 87.7; Upper Lake Region, 86.3; Tennessee and the Ohio Valley, 85.6; Upper Mississippi Valley, 85.3; Lower Missouri Valley, 83.7. Of the 3,352 predictions that have been made 53 or 1.6 per cent, are considered to have entirely failed; 103 or 3.1 per cent., were one-fourth verified; 433 or 12.9 per cent., were half verified; 450 or 13.4 per cent., were three-fourths verified; 2,313 or 69.0 per cent., were fully verified so far as can be judged from the weather maps.

*Cautionary Signals*.—During the past month 139 Cautionary Signals have been displayed at 34 stations on the Gulf and Atlantic coasts and on Lake Michigan; of which, 120, or 86.3 per cent., were reported verified within one hundred miles of the station. One signal was ordered up late. Thirty-nine cases of winds, of 25 miles or over, per hour, have also been reported at these stations, for which no signals were displayed.

## NAVIGATION.

*Stages of Water in Rivers*.—In the table on chart No. III are given the highest and lowest readings, for the month, on the Signal Service river-gauges, from which it will be seen that the danger line on gauge has not been reached at any of the stations mentioned, and that the nearest approach to it occurred at Shreve-

port and Vicksburg. In the Lower Mississippi the lowest readings were recorded during the early part of the month, and the highest on the 27th and 28th.

*Ice in Rivers and Harbors.*—The following items will serve to show the conditions of the rivers and harbors in this respect: The Missouri, at Yankton, was frozen over until the 20th, when the ice broke, and the river has since continued open; at Omaha the ice broke on the 15th and 16th, and on the 19th the river was open for navigation; at Leavenworth it remained open throughout month. The Mississippi remained frozen over at St. Paul until the 28th, when the ice broke up and moved out; at La Crosse it remained closed until the 7th, when it commenced breaking up in the channel; on the 10th and 16th floating ice passed down from the La Crosse river, and from the 20th to 22nd shore ice gave way, and ferry-boat commenced running; Guttenburg, 2nd, river frozen over; 17th, clear; at Dubuque the ice broke up from 5th to 7th; on the 19th river was full of floating ice, but the observer states that "local navigation was practically uninterrupted during the month;" at Davenport, 1st to 4th, 9th to 12th and the 17th, floating ice; at Keokuk, on the 3d, the river was clear; 10th, slush ice; 12th, clear; Muscatine, 5th, ice in river 9 in.; 19th, clear. On the *Lakes* ice is reported as follows: Duluth, 28th, ice in bay broken up by high winds. Marquette, 5th, ice in harbor broke up; 10th, ice formed; 13th, broke up; 15th, formed; 21st, broke up. Escanaba, ice in bay throughout month. Chicago, 1st to 25th, lake frozen; 26th, shore ice floating off. Grand Haven, 12th, river frozen over. Alpena, river frozen throughout month; 10th, bay entirely clear of ice; 18th, frozen over; 23rd, clear. Detroit, 1st and 3rd, river frozen; 4th, ice broke up. Toledo, 1st to 21st, Maumee river frozen over; 22nd, broke up and cleared away from dock; at 2:45 p. m., an immense field of ice came down sweeping away span of new railroad bridge. Cleveland, 1st to 25th, floating ice. Buffalo, 1st to 23rd, river frozen; 24th, broke up; 28th, river and harbor clear. Fort Niagara, 1st, river full of floating ice; 9th, clear. Sebago Lake, Me., 28th, 15 inches ice in lower bay, "upper bay only frozen over one day this winter." Lake Champlain, at West Charlotte, Vt., 7th, partly frozen; 8th, ice all gone, except in bays; 15th, much floating ice. The Hudson river, at Wappinger's Falls, 4th, firm; 20th, ice 10 inches thick; 26th, ice spongy; 27th, ice moving; 28th, river open to Poughkeepsie, navigation resumed. Albany, 28th, ice breaking up. West Point, 27th, first steamer passed up river. Ardenia, river open throughout month. Rockford, Ill., 5th, river clear; 11th, frozen over; 14th, clear. Morristown, Dak., 28th, "James river nearly open." New London, Conn., 14th, Thames river full of floating ice from Shetucket.

## TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors, is shown in table on chart No. III.

*Maximum and Minimum Temperatures.*—The highest maxima have been: 65° at St. Marks, 63° at Galveston and Jacksonville, 56° at Augusta, Montgomery and Savannah, and 55° at Charleston and Mobile. The lowest minima have been: 29° at Portland, Me., 30° at Keokuk, 31° at Wood's Holl and New York city, and 32° at Sandusky.

*Ranges of Temperature.*—The least have been: 1° at Detroit and Duluth, 2° at Eastport and Grand Haven, 3°.5 at Milwaukee, and 4° at Charleston, New London, Sandusky and Wilmington. The largest: 12° at Galveston, 11° at Keokuk, Montgomery and St. Louis, and 10° at St. Marks.

## ATMOSPHERIC ELECTRICITY.

*Thunder-Storms.*—4th, Tex.; 6, Tex., La.; 7th, Fla., Ala., Ga., La., S. C.; 8th, Ala., N. C., Miss., Va.; 9th, Fla., Tenn., Ga., Ala., Ind., Ky., Ohio; 10th, Va.; 12th, Tex.; 13th, Cal., Miss., Ala.; 14th, Fla., La.; 15th, Fla.; 17th, Ga., N. C.; 19th, Tex., Iowa, Ill., Mo.; 20th, Ind. Ty., Kan., Tex., Miss., Ala., Tenn., Ark., La., Mo., Ohio; 21st, Ala., Tenn., Ky., S. C., Fla., Ga., Ind., Mo., N. C., Ohio, Pa.; 22d, Md., N. J., N. Y., Pa., Tex., Va.; 23d, Fla., Md.; 24th, Kan., N. C.; 26th, Fla., Tex.; 27th, Fla.; 28th, N. M., Neb., Kan., Ga.

*Distant Lightning.*—On the 7th at N. C., Fla., and Ga.; 9th, N. C.; 21st, N. C. and Ga.; 22nd, Tex., N. C. and Md.; 27th, Col.; 28th, Col.

*Auroras.*—On the 5th at Cornish and Orono, Me., Contookookville and Mt. Washington, N. H.; 12th, Creco, Iowa; 19th, Atco, N. J.; 26th, Escanaba and Alpena, Mich.; 27th, Albany, N. Y.; 26th, during sand-storm at Visalia, Cal., electricity intense; 28th, Santa Fe, atmospheric electricity intense, interfering with working of line. Pike's Peak, the assistant on station at summit, in ascending the mountain encountered severe electric storm at timber line, in which his hair crackled, and he experienced a severe burning sensation all over the head.

*Magnetic Phenomena.*—The average diurnal magnetic range in declination, is again reported by Prof. Hibrichs, of Iowa City, as 4½ minutes.

## OPTICAL PHENOMENA.

*Solar Halos.*—2nd, Dak., Iowa, Kan.; 3rd, Ill., Iowa, Mich.; 4th, Conn.; 5th, Mich., Pa., La., Iowa, Fla.; 6th, Dak., Iowa, Neb., Ga., Vt.; 7th, Iowa, Neb., Ohio, Wis.; 8th, N. H., Wis., Cal., Col.; 9th, Iowa, Mich., Wis., Cal.; 10th, Ill., Iowa, Neb., Cal., Mich.; 11th, Ill., Ind., Iowa, Mich., Neb., Wis., Ohio, R. I., Mass.; 12th, Conn., N. H., Ohio, Tenn., Ala., La., Fla., Ga., R. I.; 13th, Ill., Ind., Iowa, Ohio, W. Va.; 14th, Ill., Ind., Mich., N. Y., Ky.; 15th, Conn., Ind., Me., Mass., N. H., N. Y., Vt., Tex.; 16th, Conn., Mo.,